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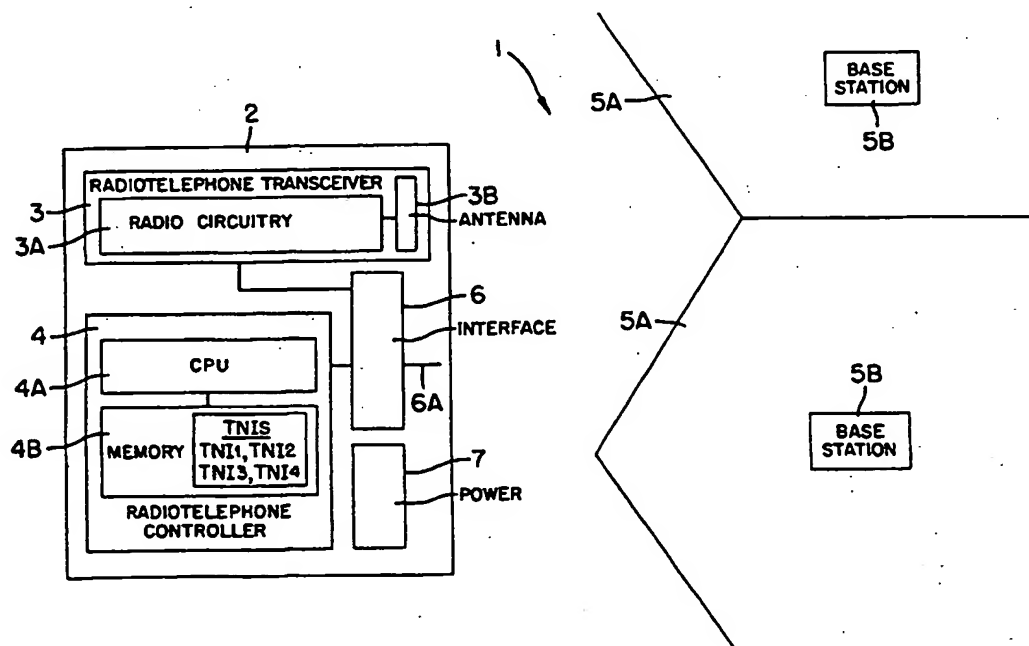
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(54) Title: **RADIOTELEPHONE WITH MULTIPLE SIMULTANEOUS TELEPHONE NUMBER IDENTITIES**



(57) Abstract

A radiotelephone apparatus (2) in which a radiotelephone transceiver monitors a control channel for paging signals and a controller automatically controls a radiotelephone transceiver to generate an acknowledgement signal in response to receipt of a paging signal carrying a telephone number identity which is any one of a plurality of predetermined telephone number identities.

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RADIOTELEPHONE WITH MULTIPLE SIMULTANEOUS TELEPHONE NUMBER
IDENTITIESBACKGROUND OF THE INVENTION

1
2
3 This invention relates to radiotelephones and, in
4 particular, to radiotelephones having multiple telephone number
5 identities.

6 In a typical radiotelephone, the radiotelephone
7 includes a radiotelephone transceiver which receives
8 radiotelephone signals from and transmits radiotelephone
9 signals to a radiotelephone telephone system in which the
10 radiotelephone is situated. The radiotelephone transceiver is
11 controlled by a radiotelephone controller, usually including a
12 program driven microprocessor and a memory.

13 In a standard radiotelephone, the radiotelephone
14 controller controls the radiotelephone transceiver to receive
15 and transmit control signals on one or more control channels of
16 the radiotelephone system. One type of control signal is a
17 paging signal which is broadcast by the radiotelephone system
18 to initiate an incoming call to a radiotelephone. Another type
19 of control signal is an access signal which is transmitted by a
20 radiotelephone into the system to initiate an outgoing call
21 from the radiotelephone.

22 Each paging signal and each access signal includes
23 identifying data or information which is used to identify the
24 particular radiotelephone associated with the signal. In
25 particular, each such signal includes a telephone number
26 identity (TNI) which identifies the radiotelephone in terms of
27 a telephone number or routing number in the radiotelephone system.

1 The TNI of a radiotelephone is usually stored in the
2 memory of the radiotelephone controller and is retrieved for
3 processing of each paging signal received by the radiotelephone
4 transceiver and for generating each access signal to be
5 transmitted by the transceiver. When a paging signal is
6 received by a radiotelephone transceiver, the transceiver
7 couples the paging signal to the radiotelephone controller.
8 The radiotelephone controller then extracts from the paging
9 signal the TNI carried by the paging signal and also retrieves
10 from its memory the TNI of its radiotelephone and compares the
11 two TNIs. If a match is found, the radiotelephone controller
12 recognizes that the paging signal is for it and that the call
13 associated with the paging signal is for its radiotelephone.
14 Accordingly, the radiotelephone controller causes the
15 radiotelephone transceiver to transmit a response signal into
16 the radiotelephone system so that the call connection process
17 to the radiotelephone can be continued and completed.

18 As can be appreciated, with the above standard
19 radiotelephone, the radiotelephone has only a single TNI and
20 thus can only respond to paging signals, i.e., incoming calls,
21 and generate access signals, i.e., initiate outgoing calls,
22 based on this single TNI. In order to add more flexibility to
23 the standard radiotelephone, modifications to the
24 radiotelephone have been made which permit the radiotelephone
25 to operate based on multiple TNIs. In these modified

1 radiotelephones, user switches on the radiotelephone permit the
2 user to select which one of the multiple TNIs is to be active
3 for the radiotelephone and, therefore, to be retrieved from its
4 memory in connection with the processing of incoming paging
5 signals and the generating of outgoing access signals.
6 Accordingly, once the user selects a particular TNI, the
7 radiotelephone will only use this TNI for processing all
8 incoming and outgoing calls. Radiotelephones of this type are
9 disclosed, for example, is U.S. Patents Nos. 4,734,928 and
10 5,020,091.

11 More particularly, in the 4,734,928 patent a
12 radiotelephone with multiple TNIs is disclosed in which a user
13 can manually select different telephone numbers for use with
14 different radiotelephone systems or for use with outgoing and
15 incoming calls. In the 5,020,091 patent, the radiotelephone
16 prompts a user when the user moves into a different telephone
17 system, and the user can manually select the TNI assigned to
18 that system. However, these radiotelephones still have limited
19 application, since, at any given time, a radiotelephone is
20 automatically active for only a single, manually selected TNI.

21 It is, therefore, an object of the present invention
22 to provide a radiotelephone having an improved and more
23 flexible ability to take on TNIs.

24 It is a further object of the present invention to
25 provide a radiotelephone meeting the aforesaid object and which

1 is further adapted for use in a radiotelephone system as
2 disclosed in U.S. Patent Application Serial No. 08/114,648
3 assigned to the same assignee hereof.

4
5 SUMMARY OF THE INVENTION

6 In accordance with the principles of the present
7 invention, the above and other objectives are realized via a
8 radiotelephone transceiver which is adapted to receive and
9 transmit paging and access signals respectively, which include
10 TNIs and which are associated with respective incoming and
11 outgoing telephone calls and further via a controller for
12 automatically controlling the radiotelephone to cause the
13 radiotelephone transceiver to respond to paging signals
14 carrying any one of a plurality of predetermined TNIs. The
15 controller is further adapted to automatically cause each
16 access signal from the transceiver to include any one of the
17 predetermined TNIs.

18 The transceiver of the invention is thus able to
19 automatically respond to a paging signal and/or automatically
20 generate an access signal having any of the plurality of the
21 predetermined TNIs all of which are active and able to be
22 selected during the time that the radiotelephone transceiver is
23 able to receive and respond to paging signals and/or the time
24 the radiotelephone transceiver is able to generate and
25 establish access signals. This adds considerable flexibility

1 to the operation of the radiotelephone transceiver and
2 controller combination.

3 The controller used with the radiotelephone
4 transceiver can be a radiotelephone controller which together
5 with the radiotelephone transceiver forms a radiotelephone.
6 The controller can also be a separate unit from the
7 radiotelephone transceiver and its radiotelephone controller,
8 in which case the controller acts to establish for the
9 radiotelephone controller its TNI by instructing the
10 radiotelephone controller to take on one of the predetermined
11 plurality of TNIs.

12 In a further aspect of the invention, multiple
13 combinations of respective radiotelephone transceivers and
14 radiotelephone controllers are used in a system and share the
15 plurality of predetermined TNIs. In this case, the controller
16 includes an arbitration function which determines or selects
17 which of the radiotelephone controllers is to handle an
18 incoming call and, therefore, take on the associated TNI.

19 The functions of the controller serving the multiple
20 radiotelephones can also be incorporated into the
21 radiotelephone controller of one of the radiotelephones which
22 then acts as a master radiotelephone with the other
23 radiotelephones acting as slave radiotelephones.

24 In still a further aspect of the invention, the
25 system of multiple radiotelephones is incorporated into the

1 radiotelephone system of the '648 patent application to
2 simplify the system.

3 BRIEF DESCRIPTION OF THE DRAWINGS

4 The above and other features and aspects of the
5 present invention will become more apparent upon reading the
6 following detailed description in conjunction with the
7 accompanying drawings, in which:

8 FIG. 1 shows a block diagram of a radiotelephone
9 system employing a radiotelephone in accordance with the
10 principles of the present invention;

11 FIG. 2 shows a modification of the radiotelephone of
12 FIG. 1;

13 FIG. 3 shows a modification of the radiotelephone of
14 FIG. 2 forming an assembly in which a plurality of
15 radiotelephones is used;

16 FIGS. 4 and 5 show further modifications of the
17 radiotelephone assembly of FIG. 3; and

18 FIG. 6 shows the radiotelephone assembly of FIG. 5
19 incorporated into the radiotelephone system of the '648
20 application.

21
22 DETAILED DESCRIPTION

23 FIG. 1 illustrates a cellular radiotelephone system 1
24 which employs a radiotelephone 2 in accordance with the
25 principles of the present invention. As shown, the

1 radiotelephone 2 includes a transceiver 3 comprised of radio
2 circuitry 3A and an antenna 3B which allows the radiotelephone
3 2 to transmit radio signals into and receive radio signals from
4 the radiotelephone system 1. The latter system is shown
5 schematically as including cells 5A having base stations 5B
6 which transmit radio signals to and receive radio signals from
7 the radiotelephones in their respective cells.

8 The radiotelephone 2 also includes a radiotelephone
9 controller 4 having a microprocessor or central processing unit
10 4A and memory 4B which usually contains both permanent and
11 temporary storage units. An interface circuit 6 communicates
12 with the controller 4 and transceiver 3 and includes a
13 communications bus 6A which is of the type used to carry
14 signals and data from the radiotelephone. This bus normally is
15 coupled to a handset (not shown) where the radiotelephone is to
16 interface directly with a user. A power source 7 provides
17 power to the aforesaid components of the radiotelephone.

18 As is well known, the radiotelephone system 1
19 operates over a number of channels which carry various signals
20 between the base stations 5B and the radiotelephones of the
21 system. While the majority of these channels are dedicated to
22 carrying voice signals, a number are used as control channels
23 for carrying control signals and identification information.

24 Two types of control signals carried by a control
25 channel are paging signals and access signals. A paging signal

1 is broadcast by a base station 5B in its control channels and
2 is used to establish a call to a radiotelephone. This is
3 accomplished by including in the paging signal the telephone
4 number identity (TNI) associated with the radiotelephone being
5 called.

6 When a paging signal is received by the transceiver 3
7 of the radiotelephone 2, the signal is coupled from the
8 transceiver 3 to the radiotelephone controller 4 which extracts
9 from the paging signal the TNI. The radiotelephone controller
10 4 then recalls from the memory unit 4B, the resident TNI for
11 the radiotelephone. If the resident TNI and the paging signal
12 TNI match, the radiotelephone 2 then responds to the page with
13 an acknowledgement signal which is transmitted by the
14 transceiver 3 on the appropriate control channel. This signal
15 is then received by the base station 5B transmitting the paging
16 signal, and the base station 5B continues with processing of
17 the call connection.

18 In accordance with the principles of the present
19 invention, the radiotelephone 2 is adapted such that it is
20 capable of automatically responding to paging signals carrying
21 any one of a plurality of TNIs. More particularly, the
22 radiotelephone 2 is adapted so that its memory unit 4B includes
23 a plurality of TNIs (shown as TNI1 to TNI4 in FIG. 1) and so
24 that the radiotelephone can respond to paging signals carrying
25 any of these TNIs.

1 Accordingly, with the radiotelephone 2 so adapted,
2 when an incoming paging signal is sent by the transceiver 3 to
3 the radiotelephone controller 4, the radiotelephone controller
4 4 now compares the TNI carried in the paging signal with each
5 of the TNIs TNI1 to TNI4. If a match is found with any one of
6 these TNIs, the radiotelephone 2 takes on this TNI. More
7 particularly, the radiotelephone controller 4 of the
8 radiotelephone 2 uses this TNI to cause the radiotelephone
9 transceiver 3 to acknowledge the paging signal in usual fashion
10 thereby continuing with the call connection.

11 The radiotelephone 2 of the invention thus has a
12 plurality of TNIs which are all active and able to be used at
13 all times when the radiotelephone is able to receive and
14 respond to a paging signal.

15 As above-indicated, the control channel of the
16 radiotelephone system 1 carries access signals as well as
17 paging signals. An access signal is generated by a
18 radiotelephone when it wishes to commence an outgoing call from
19 the radiotelephone. The access signal includes the TNI of the
20 radiotelephone which is retrieved by the radiotelephone
21 controller from the memory of the radiotelephone and included
22 in the access signal when generated and transmitted by the
23 radiotelephone transceiver.

24 In the case of the radiotelephone 2 of the invention,
25 when an access signal is to be generated, the radiotelephone

1 controller 4 automatically determines or selects which one of
2 the TNIs TNI1 to TNI4 it wishes to take on for the outgoing
3 call and automatically retrieves this selected TNI from the
4 memory 4B. The retrieved TNI is then included in the access
5 signal generated by the radiotelephone transceiver 3 and
6 transmitted on the control channel. The radiotelephone 2 will
7 thus have this TNI for the outgoing call.

8 In the embodiment of the invention in FIG. 1, the
9 radiotelephone controller 4 itself stores and compares the
10 plurality of predetermined TNIs TNI1 to TNI4 with the TNI in an
11 incoming paging signal and provides selection of the TNI for an
12 outgoing access signal. FIG. 2 shows a second embodiment of
13 the invention in which these functions are carried out by an
14 external memory 12 and an external controller 11 which includes
15 a microprocessor or central processing unit 11A.

16 In the embodiment of the invention of FIG. 2, the
17 external memory 12 stores the TNIs TNI1 to TNI4. The external
18 controller 11, in turn, communicates with the radiotelephone 2
19 over the interface bus 6A. In particular, the radiotelephone
20 controller 4 of the radiotelephone 2 is adapted to communicate
21 to the external controller 11 over the interface bus 6A, all
22 paging signals and requests for access signals. The
23 radiotelephone controller 4 then awaits a command signal from
24 the external controller 11.

25

1 In the case of a transmitted paging signal, if the
2 TNI of the paging signal matches one of the TNIs TNI1 to TNI4
3 stored in the external memory 12, the external controller 11
4 sends a command which includes the matched TNI to the
5 radiotelephone controller 4 instructing the radiotelephone
6 controller to respond to the paging signal with this TNI. The
7 matched TNI is now used to alter any resident TNI stored in the
8 memory 4B. It is also included in the acknowledgement to the
9 paging signal transmitted by the radiotelephone controller 4
10 and transceiver 3 into the system 1 so that the procedure for
11 the incoming call set up is continued.

12 In the case of a request for an access signal, the
13 external controller 11 selects which of the TNIs TNI1 to TNI4
14 is to be used in the access signal for the outgoing call. The
15 selected TNI, after retrieval from the external memory 12, is
16 sent by the external controller 11 over the communication bus
17 6A to the radiotelephone controller 4 where it is then used to
18 alter any resident TNI stored in the memory 4B and as the TNI
19 for the access signal of the outgoing call.

20 FIG. 3 shows a further modification of the embodiment
21 of FIG. 2 in which additional radiotelephones are added to the
22 assembly and commonly share or can take on the plurality of
23 predetermined telephone identities TNI1 to TNI4. In this case,
24 the buses 6A of the radiotelephones 2 each communicate with

1 the external controller 11 to communicate paging signals and
2 access request signals to the controller.

3 When an incoming paging signal is received by one or
4 more of the radiotelephones 2 and communicated by the
5 radiotelephone to the external controller 11, the external
6 controller first determines whether the TNI in the paging
7 signal is a match with any one of the TNIs TNI1 to TNI4. If a
8 match is found, the external controller 11, based upon a
9 predetermined arbitration or selection function, selects or
10 determines which of the radiotelephones is to handle the
11 incoming call associated with the paging signal.

12 Once this selection is made the external controller
13 11 sends a command signal to the selected radiotelephone 2,
14 including the matched TNI, instructing the radiotelephone 2 to
15 acknowledge the paging signal using this TNI. The selected
16 radiotelephone alters its memory 4B by replacing any resident
17 TNI with the matched TNI, and then the radiotelephone
18 controller 3 and transceiver 4 of the radiotelephone 2 cause an
19 acknowledgement signal to be generated and transmitted to
20 continue with the call setup and connection.

21 When a radiotelephone 2 of FIG. 3, on the other hand,
22 generates an access signal request, the request is communicated
23 from its radiotelephone controller 4 over its bus 6A to the
24 external controller 11. The controller 11 then selects an
25 appropriate TNI from the TNIs TNI1 to TNI4 in the external

1 memory 12 and communicates it back to the radiotelephone
2 controller. The radiotelephone controller then alters any
3 resident TNI in its memory with the selected TNI and causes
4 generation and transmission by its radiotelephone transceiver
5 of an access signal with the selected TNI.

6 The radiotelephones 2 and the external controller 11
7 of the assemblies of FIGS. 2 and 3 can also be adapted so that
8 the operation of the system is simplified. In particular, the
9 radiotelephones 2 and external controller 11 can be operated so
10 that each radiotelephone 2 has normal, monitor and slave modes
11 of operation.

12 In a normal mode of operation, a radiotelephone 2
13 acts as any radiotelephone to lock onto a control channel and
14 to also respond to paging signals and generate access signals
15 based upon a resident TNI in the memory of the radiotelephone.
16 In a monitor mode of operation, a radiotelephone 2 does not
17 respond to paging signals, but instead will direct all paging
18 signals to the external controller 11 over its interface bus
19 6A.

20
21 In a slave mode of operation, a radiotelephone 2
22 responds to paging signals, only if an appropriate command
23 signal is or has been received from the external controller
24 11. A command signal will include one of the TNIs TNI1 to TNI4
25 selected by the external controller 11 and will also include

1 one of the Command Words A, B or C which command the
2 radiotelephone to perform the following respective actions:
3 (a) Command Word A - store the data transmitted with the
4 command, but do not respond to any page; (b) Command Word B -
5 assume a page has occurred and respond with an acknowledgement
6 immediately with the stored data transmitted with the command
7 including the selected TNI; or (c) Command Word C - respond
8 only to the next page whose TNI corresponds to the TNI
9 transmitted with the command.

10 With the radiotelephones 2 adapted to have the
11 aforesaid operating modes, the assembly of FIG. 3 can be
12 operated in the following manner. Upon initialization, each
13 radiotelephone 2 enters the normal mode. In this mode, each
14 radiotelephone 2, via its radiotelephone transceiver 3 and its
15 radiotelephone controller 4, monitors the control channels of
16 the system 1 and locks onto the control channel with the
17 strongest signal.

18 The external controller 11 then places one of the
19 radiotelephones 2 in the monitor mode and one or more of the
20 other radiotelephones 2 in the slave mode. The radiotelephone
21 2 in the monitor mode communicates all its received paging
22 signals to the external controller 11 and the controller 11, in
23 turn, processes each paging signal by comparing the TNI in the
24 paging signal with the TNIs TNI1 to TNI4. If a match occurs
25 for a comparison, the controller 11 sends a command including a

1 Command Word, e.g., the Command Word B, and the matched TNI, to
2 one of the radiotelephones 2 in the slave mode, as determined
3 or selected by the controller 11 using its arbitration or
4 selection function.

5 Upon receipt of this command including the Command
6 Word B, the radiotelephone controller 4 of the selected slave
7 radiotelephone 2, having altered its resident TNI in the memory
8 4B with the received TNI in the command, formulates an
9 appropriate acknowledgement signal which is then transmitted by
10 the radiotelephone transceiver 3. This continues the call
11 setup process with the call now being completed through the
12 acknowledging slave radiotelephone.

13 In the above description of the assembly of FIG. 3,
14 if all the slave radiotelephones 2 are busy with calls when a
15 paging signal is transmitted by the monitoring radiotelephone 2
16 to the controller 11 and the controller 11 finds a match, the
17 controller 11 can instruct the monitoring radiotelephone 2 to
18 switch from its monitor mode to its slave mode. The controller
19 11 then sends a command as above-described to the switched
20 radiotelephone including the matched TNI, thereby instructing
21 the radiotelephone to respond to the paging signal with this
22 TNI.

23 The assembly of FIG.3 can also be operated with the
24 functions of the controller 11 and memory 12 carried out by and
25 incorporated into any one of the radiotelephones 2. This is

1 illustrated in FIG. 4. In such case, upon initialization, each
2 radiotelephone 2 will again go into its normal mode first and
3 lock onto a control channel of the system 1. One of the
4 radiotelephones will then act as master in which it monitors
5 all paging signals and provides the control and memory
6 functions of controller 11 and memory 12. The other
7 radiotelephones 2 will be placed in the slave mode to be
8 controlled by the master radiotelephone 2 in response to paging
9 signals. In this case also, the master radiotelephone can
10 switch to a slave mode and respond to a paging signal, if all
11 the current slave radiotelephones 2 are busy.

12 It should be noted that system of FIG. 4 can also be
13 modified so that some or all of the functions needed to
14 implement the invention in the radiotelephone controller 4 are
15 carried out in an adjunct controller which communicates with
16 the radiotelephone controller. This is illustrated in FIG. 5
17 where adjunct controllers 41 to 44 communicate with the
18 radiotelephone controllers 4 of the radiotelephones 2. As
19 shown, the adjunct controller 41 has taken on the role of
20 master controller, while the adjunct controllers 42 to 44 have
21 taken on the roles of slave controllers. Also, a private bus
22 45 is included to provide a local area network type
23 communication between the adjunct controllers.

24 FIG. 6 illustrates the radiotelephone assembly of
25 FIG. 5 utilized in the telephone system of the '648

1 application, the teachings of which are incorporated herein by
2 reference. In the telephone system of FIG. 6, the assembly of
3 FIG. 5 is used to communicate with the trunks of a telephone
4 switching system, such as a private branch exchange (PBX), via
5 the interface circuits of the '648 application, so as to permit
6 the telephone stations served by the PBX to have direct access
7 to the radiotelephone system.

8 As shown in FIG. 6, the telephone system 100
9 comprises subscriber telephone stations 61, which may be dial
10 pulse, DTMF or ISDN stations, having directory or routing
11 numbers RN. Only the routing number (373-1234) of one station
12 is actually illustrated. The telephone stations communicate
13 with and are served by a public switched telephone network
14 (PSTN) 60.

15 The system 100 also comprises a radiotelephone system
16 70. The system 70 includes standard radiotelephones 71 as well
17 as a radiotelephone assembly 50 as shown in FIG. 5 which
18 includes the radiotelephones 2. The system 70 also utilizes
19 base stations 72 which are associated with respective cells 73
20 and which radiocommunicate with the radiotelephones in such
21 cells.

22 A mobile telephone switching Office (MTSO) 74
23 included in the system 70 provides selective linking or
24 interconnection amongst the base stations 72 for calls to and
25 from the radiotelephones of the system. Trunk circuits 75 link

1 the MTSO 74 to the PSTN 60. This permits calls to be effected
2 between the radiotelephones 71 and radiotelephone assembly 50
3 and the subscriber telephone stations 61.

4 As described in the '648 application, interfaces 80
5 permit the standard trunk circuits 91 of a further telephone
6 switching system, shown as PBX 90, to directly access a
7 radiotelephone of the radiotelephone system 70. The PBX 90
8 serves telephone stations 92, which may be dial pulse, DTMF or
9 ISDN stations. These stations are thus able to access the
10 radiotelephone system 70 via the PBX 90, trunks 91 and
11 interfaces 80.

12 As described in the '648 application, each interface
13 circuit 80 interfaces the standard supervision used with its
14 associated trunk circuit 91 with the corresponding
15 radiotelephone for effecting call originations and
16 terminations. Each interface 80 additionally interfaces the
17 standard signaling used with its respective trunk circuit 91
18 with its corresponding radiotelephone for effecting transfer of
19 information.

20 In accordance with the principles of the present
21 invention, each of the interfaces 80 and its respective
22 standard telephone trunk circuit 91 are coupled into the
23 radiotelephone system 70 through a radiotelephone 2 of the
24 radiotelephone assembly 50. By utilizing the radiotelephones 2
25 of the assembly 50, instead of the standard radiotelephones 71,

1 to provide this coupling the routing correlator described in
2 the '648 application can be dispensed with, thereby reducing
3 the cost and simplifying the telephone system 100.

4 In particular, the radiotelephone assembly 50 permits
5 the MTSO 74 to use a different radiotelephone routing number RN
6 for each of the telephone stations 92 served by the PBX 90.
7 Each such radiotelephone routing number RN is included in the
8 predetermined plurality of TNIs which the radiotelephones 2 of
9 the assembly 50 can take on. Moreover, each such
10 radiotelephone routing number RN can be the same number as the
11 telephone number of its associated telephone station 92. Each
12 such radiotelephone number can also differ from the telephone
13 number of its associated station 92 by one or more or all
14 digits, in which case the assembly 50 will correlate the
15 radiotelephone routing number with the telephone number of the
16 associated telephone station.

17 As a result, a call to any one of these
18 radiotelephone routing numbers, after the call is passed by the
19 MTSO 70 and appropriate base station 71 to the radiotelephone
20 assembly 50, will result in a match with a corresponding TNI in
21 the assembly. A radiotelephone 2 will thus be selected to
22 acknowledge and take on the call with the matched TNI. The
23 selected radiotelephone will then pass the call to its
24 interface 80 with the appropriate telephone number (i.e., the
25 radiotelephone number, if it is the same as the telephone

1 number of the called station 92, or the telephone number
2 determined based on correlation from the radiotelephone number,
3 if the radiotelephone number is different from the telephone
4 number of the called station 92).

5 The interface 80 will then pass the call and the
6 appropriate number of digits of the telephone number needed by
7 the PBX 90 to make a connection with the corresponding
8 telephone station. The PBX 90 will generally need less than
9 the total number of digits of the telephone number to complete
10 a connection and when it receives these digits it will complete
11 the connection to the associated telephone station 92.

12 A more detailed description of the system of FIG. 6
13 will now be given. In this description, it is assumed that the
14 telephone stations 92 served by the PBX 90 have incoming
15 numbers as follows: 555-4001; 555-4002; 555-4003; and 555-
16 4004. It is further assumed that the radiotelephone routing
17 numbers associated with these telephone numbers are the same as
18 the telephone numbers. Accordingly, as indicated, the TNIs
19 stored in the memory of the master adjunct controller 41 of the
20 assembly 50 will include these telephone numbers as the
21 radiotelephone routing numbers for incoming calls.

22 The flow for a call from a telephone station 61
23 connected to the PSTN 60 to the telephone station 92 connected
24 to the PBX 90 and having the telephone number 555-4003 will now
25 be described. When a subscriber at the station 61 dials the

1 radiotelephone routing number 555-4003, the call and routing
2 number are passed to the PSTN 60 which recognizes from the
3 routing number that the call is to be carried via the
4 radiotelephone system 70.

5 The PSTN 60 seizes an idle one of the trunks 75 and
6 the call and routing number 555-4003 are passed to the MTSO 74
7 of the radiotelephone system 70. The MTSO 74 then identifies
8 from the routing number that the call is to be routed through
9 the base station 72 and cell 73 serving the radiotelephone
10 assembly 50 which has this routing number.

11 The call and routing number 555-4003 are then passed
12 to the appropriate base station 72 and the base station
13 transmits a paging signal containing the routing number 555-
14 4003 as the TNI of the called radiotelephone. The paging
15 signal is received by the radiotelephone transceiver 3 of the
16 radiotelephone 2 of the master radiotelephone of the assembly
17 50 and the paging signal is passed to the master adjunct
18 controller 41. This controller extracts the TNI 555-4003 in
19 the paging signal and compares it with the TNIs 555-4001, 555-
20 4002, 555-4003 and 555-4004 stored in its memory.

21 When the controller 41 reaches the stored TNI 555-
22 4003, a match is found and the master adjunct controller 41,
23 using its arbitration and selection function, then selects one
24 of the slave radiotelephones 2 to handle the incoming call and
25 take on the TNI 555-4003. Assuming that the master adjunct

1 controller 41 selects the radiotelephone 2 served by the slave
2 adjunct controller 42, the master controller then transmits a
3 command message with a COMMAND WORD B and the matched TNI 555-
4 4003 to the slave adjunct controller 42.

5 The slave adjunct controller 42 then alters the
6 resident TNI in its memory with the matched TNI 555-4003 and
7 causes an acknowledgement to the paging signal to be generated
8 and transmitted by the controller 3 and transceiver 4 of its
9 associated radiotelephone 2. The slave adjunct controller 42
10 also passes the call and matched TNI to its associated
11 interface 80 which seizes an idle trunk 91 toward the PBX 90.

12 The PBX 90 acknowledges this seizure with a wink
13 signal and the interface 80 forwards the call and the
14 appropriate number of digits of the matched TNI 555-4003 to the
15 PBX. The PBX then rings the telephone station 92 having the
16 telephone number 555-4003 of the matched TNI 555-4003. Upon
17 the telephone station 92 answering, the PBX 90 passes answer
18 supervision to the interface 80, whereupon the interface 80
19 instructs the slave adjunct controller 42 to effect completion
20 of the call connection.

21 Having followed the flow of an incoming call, an
22 outgoing call from a telephone station 92 to the telephone
23 station 61 having the routing number 373-1234 will now be
24 described. Upon a station 92 dialing the routing number 373-
25 1234, the routing number and call are conveyed to the PBX 90

1 which seizes an idle trunk 91 toward one of the interfaces 80.
2 The interface 80 of the seized trunk acknowledges this seizure
3 of the trunk with a wink signal towards the PBX 90. The PBX
4 then passes the call and the routing number 373-1234 to the
5 interface 80.

6 The interface 80 thereupon communicates an outgoing
7 call request to its respective adjunct controller in the
8 radiotelephone assembly 50. It is assumed for the present
9 discussion that the controller 43 has been seized so that the
10 slave adjunct controller 43 receives the call request from its
11 interface 80.

12
13 The slave adjunct controller 43 then transmits an
14 access request signal to the master adjunct controller 41. In
15 response to this request, the controller 41 selects an idle one
16 of the stored TNIs assigned to outgoing calls (i.e., one of the
17 TNIs 555-4005, 555-4006, 555-4007, 555-4008). The selected TNI
18 is then communicated by the master adjunct controller 41 to the
19 slave adjunct controller 43. The slave adjunct controller 43
20 then stores this TNI in its memory and causes its associated
21 radiotelephone controller 4 and transceiver 3 to transmit an
22 access message into the radiotelephone system 70 with the
23 selected TNI.

24 The base station 72 serving the radiotelephone
25 assembly 50 passes the access message to the MTSO 74 which

1 grants access for the outgoing call. The slave adjunct
2 controller 43 then causes its respective radiotelephone
3 controller 4 and radiotelephone transceiver 3 to pass the call
4 and routing number 373-1234 to the MTSO 74. The MTSO 74
5 recognizes from the routing number that it is for a telephone
6 station served by the PSTN 60 and, therefore, seizes an idle
7 trunk 75 to the PSTN. The MTSO 74 then passes the routing
8 number 373-1234 and call to the PSTN 60, which rings the
9 telephone station 61 having the routing number 373-1234 to
10 complete the call.

11 In all cases it is understood that the above-
12 described arrangements are merely illustrative of the many
13 possible specific embodiments which represent applications of
14 the present invention. Numerous and varied other arrangements,
15 can be readily devised in accordance with the principles of the
16 present invention without departing from the spirit and scope
17 of the invention.

18

1 WHAT IS CLAIMED IS:

2 1. A radiotelephone apparatus for use in a
3 radiotelephone system, the radiotelephone system including one
4 or more control channels in which are carried paging signals
5 which identify radiotelephones to which calls are to be
6 connected and in which are also carried acknowledgment signals
7 from the radiotelephones for continuing the set-up of calls to
8 the radiotelephones in response to paging signals identifying
9 the radiotelephones, the radiotelephone apparatus comprising:

10 at least one first radiotelephone transceiver for
11 receiving paging signals on a control channel;

12 and a controller responsive to a first radiotelephone
13 transceiver receiving a paging signal carrying a telephone
14 number identity which is any one of a plurality of
15 predetermined telephone number identities, automatically
16 controlling a radiotelephone transceiver to generate an
17 acknowledgment signal so as to continue with the set-up of a
18 call associated with the paging signal.

19 2. A radiotelephone apparatus in accordance with
20 claim 1 wherein:

21 said controller is a first radiotelephone controller
22 and forms a first radiotelephone with a first radiotelephone
23 transceiver.

24 3. A radiotelephone apparatus in accordance with
25 claim 1 further comprising:

1 at least one first radiotelephone controller, each
2 first radiotelephone controller controlling and forming a first
3 radiotelephone with a first radiotelephone transceiver and each
4 first radiotelephone controller having an alterable telephone
5 number identity;

6 and said controller, when a paging signal having a
7 particular one of said plurality of predetermined telephone
8 number identities is received by a first radiotelephone
9 transceiver, controlling a first radiotelephone controller so
10 that said alterable telephone number identity of that first
11 radiotelephone controller is the particular one of said
12 plurality of predetermined telephone number identities and so
13 that the first radiotelephone controller causes the first
14 radiotelephone transceiver with which that first radiotelephone
15 controller forms a first radiotelephone to generate an
16 acknowledgment signal.

17 4. A radiotelephone apparatus in accordance with
18 claim 3, comprising:

19 a plurality of said first radiotelephone
20 transceivers;

21 a plurality of said first radiotelephone controllers,
22 each first radiotelephone controller controlling and forming a
23 first radiotelephone with a different first radiotelephone
24 transceiver;

25 and said controller, when a paging signal having a

1 particular one of said plurality of predetermined telephone
2 number identities is received by at least one of said first
3 radiotelephone transceivers, controlling said first
4 radiotelephone controllers such that the alterable telephone
5 number identity of a particular one of said first
6 radiotelephone controllers is the particular one of said
7 plurality of predetermined telephone number identities and so
8 that the particular one of said first radiotelephone
9 controllers causes the first radiotelephone transceiver with
10 which that particular one of said first radiotelephone
11 controllers forms a first radiotelephone to generate an
12 acknowledgment signal.

13 5. A radiotelephone apparatus in accordance with
14 claim 4 wherein

15 said controller is one of said first radiotelephone
16 controllers.

17 6. A radiotelephone apparatus in accordance with
18 claim 5 wherein:

19 said controller is a master controller; and

20 each said first radiotelephone controller which is
21 other than said controller is a slave controller responsive to
22 signals from said master controller.

23 7. A telephone apparatus in accordance with claim 6
24 wherein:

25 said master controller is adapted to selectively

1 command each slave controller: to cause a paging signal
2 received by the first radiotelephone transceiver which forms a
3 first radiotelephone with that slave controller to be
4 transmitted to the master controller without an acknowledgment
5 signal responding to the paging signal being caused to be
6 generated by that slave controller; and to cause the alterable
7 telephone number identity of the slave controller to be one of
8 the predetermined telephone number identities and to cause the
9 first radiotelephone transceiver which forms a first
10 radiotelephone with that slave controller to transmit an
11 acknowledgment signal with that one of the predetermined
12 telephone number identities.

13 8. A radiotelephone apparatus in accordance with
14 claim 7 wherein:

15 each first radiotelephone controller includes: a
16 second radiotelephone controller which communicates with the
17 first radiotelephone transceiver which forms a first
18 radiotelephone with that first radiotelephone controller; and
19 an adjunct radiotelephone controller which communicates with
20 the second radiotelephone controller and with one or more
21 adjunct radiotelephone controllers of other of said first
22 radiotelephone controllers.

23 9. A radiotelephone apparatus in accordance with
24 claim 5 wherein:

25 each first radiotelephone controller includes: a

1 second radiotelephone controller which communicates with the
2 first radiotelephone transceiver which forms a first
3 radiotelephone with that first radiotelephone controller; and
4 an adjunct radiotelephone controller which communicates with
5 the second radiotelephone controller and with one or more
6 adjunct radiotelephone controllers of other of said first
7 radiotelephone controllers.

8
9 10. A radiotelephone apparatus in accordance with
10 claim 4 wherein:

11 said controller is a master controller; and
12 each said first radiotelephone controller is a slave
13 controller responsive to signals from said master controller.

14 11. A radiotelephone apparatus in accordance with
15 claim 10 wherein:

16 said master controller is adapted to selectively
17 command each slave controller: to cause a paging signal
18 received by the first radiotelephone transceiver which forms a
19 first radiotelephone with that slave controller to be
20 transmitted to the master controller without an acknowledgment
21 signal responding to the paging signal being caused to be
22 generated by that slave controller; and to cause the alterable
23 telephone number identity of the slave controller to be one of
24 the preselected number of telephone number identities and to
25 cause the first radiotelephone transceiver which forms a first

1 radiotelephone with that slave controller to transmit an
2 acknowledgment signal with that one of the predetermined
3 telephone number identities.

4 12. A radiotelephone apparatus in accordance with
5 claim 11 wherein:

6 each first radiotelephone controller includes: a
7 second radiotelephone controller which communicates with the
8 first radiotelephone transceiver which forms a first
9 radiotelephone with that first radiotelephone controller; and
10 an adjunct radiotelephone controller which communicates with
11 the second radiotelephone controller and with one or more
12 adjunct radiotelephone controllers of other of said first
13 radiotelephone controllers.

14 13. A radiotelephone apparatus in accordance with
15 claim 4 wherein:

16 each said first radiotelephone controller includes: a
17 second radiotelephone controller which communicates with the
18 first radiotelephone transceiver which forms a first
19 radiotelephone with that first radiotelephone controller; and
20 an adjunct radiotelephone controller which communicates with
21 the second radiotelephone controller and with one or more
22 adjunct radiotelephone controllers of other of said first
23 radiotelephone controllers.

24 14. A telephone system comprising:

25 a radiotelephone system operating in cells of a

1 region including: one or more radiotelephones; a radiotelephone
2 apparatus; one or more base stations for radiocommunicating
3 with the radio telephones and radiotelephone apparatus; a radio
4 telephone switching office for linking said base stations; one
5 or more control channels in which are carried paging signals
6 which identify the ones of said radiotelephones and
7 radiotelephone apparatus to which calls are to be connected and
8 in which are also carried acknowledgment signals from the
9 radiotelephones and radiotelephone apparatus for continuing the
10 set-up of calls to the radiotelephones and radiotelephone
11 apparatus in response to a paging signals identifying the
12 radiotelephones and radiotelephone apparatus; and

13 a radiotelephone apparatus including: at least one
14 first radiotelephone transceiver for receiving paging signals
15 on a control channel; and a controller responsive to a first
16 radiotelephone transceiver receiving a paging signal carrying a
17 telephone number identity which is any one of a plurality of
18 predetermined telephone number identities, automatically
19 controlling a radiotelephone transceiver to generate an
20 acknowledgment signal so as to continue with the set-up of a
21 call associated with the paging signal.

22 15. A telephone system in accordance with claim 14
23 further comprising:

24 a telephone switch;
25 one or more telephone stations linked to said

1 telephone switch;

2 one or more trunk circuits linked to said telephone
3 switch;

4 and an interface circuit interfacing one or more of
5 said one or more trunk circuits with said radiotelephone
6 apparatus.

7 16. A telephone system in accordance with claim 15
8 wherein:

9 said telephone switch is a PBX.

10 17. A telephone system in accordance with claim 15
11 further comprising:

12
13 a public switched telephone network linked to said
14 radiotelephone switching office; and

15 one or more further telephone stations linked to said
16 public switched telephone network.

17 18. A telephone system in accordance with claim 15
18 wherein:

19 said radiotelephone apparatus further comprises at
20 least one first radiotelephone controller, each first
21 radiotelephone controller controlling and forming a first
22 radiotelephone with a first radiotelephone transceiver and each
23 first radiotelephone controller having an alterable telephone
24 number identity;

25 and said controller, when a paging signal having a

1 particular one of said plurality of predetermined telephone
2 number identities is received by a first radiotelephone
3 transceiver, controlling a first radiotelephone controller so
4 that said alterable telephone number identity of that first
5 radiotelephone controller is the particular one of said
6 plurality of predetermined telephone number identities and so
7 that the first radiotelephone controller causes the first
8 radiotelephone transceiver with which that first radiotelephone
9 controller forms a first radiotelephone to generate an
10 acknowledgment signal.

11 19. A telephone system in accordance with claim 18
12 wherein:

13 said radiotelephone apparatus further comprises: a
14 plurality of said first radiotelephone transceivers; a
15 plurality of said first radiotelephone controllers, each first
16 radiotelephone controller controlling and forming a first
17 radiotelephone with a different first radiotelephone
18 transceiver; and said controller, when a paging signal having a
19 particular one of said plurality of predetermined telephone
20 number identities is received by at least one of said first
21 radiotelephone transceivers, controlling said first
22 radiotelephone controllers such that the alterable telephone
23 number identity of a particular one of said first
24 radiotelephone controllers is the particular one of said
25 plurality of predetermined telephone number identities and so

1 that the particular one of said first radiotelephone
2 controllers causes the first radiotelephone transceiver with
3 which that particular one of said first radiotelephone
4 controllers forms a first radiotelephone to generate an
5 acknowledgment signal.

6 20. A telephone system in accordance with claim 19
7 wherein:

8 said interface circuit interfaces each of said first
9 radiotelephone controllers with a different one of said one or
10 more trunk circuits;

11 21. A telephone system in accordance with claim 20
12 wherein:

13 said predetermined number of telephone identities is
14 equal to the number of telephone numbers serving said telephone
15 stations.

16
17 22. A telephone system in accordance with claim 21
18 further comprising:

19 a public switched telephone network linked to said
20 radiotelephone switching office; and

21 one or more further telephone stations linked to said
22 public switched telephone network.

23 23. A telephone system in accordance with claim 21
24 wherein

25 said controller is one of said first radiotelephone

1 controllers.

2 24. A telephone system in accordance with claim 23
3 wherein:

4 said controller is a master controller; and
5 each said first radiotelephone controller which is
6 other than said controller is a slave controller responsive to
7 signals from said master controller.

8 25. A telephone system in accordance with claim 24
9 wherein:

10 said master controller is adapted to selectively
11 command each slave controller: to cause a paging signal
12 received by the first radiotelephone transceiver which forms a
13 first radiotelephone with that slave controller to be
14 transmitted to the master controller without an acknowledgment
15 signal responding to the paging signal being caused to be
16 generated by that slave controller; and to cause the alterable
17 telephone number identity of the slave controller to be one of
18 the predetermined telephone number identities and to cause the
19 first radiotelephone transceiver which forms a first
20 radiotelephone with that slave controller to transmit an
21 acknowledgment signal with that one of the predetermined
22 telephone number identities.

23 26. A telephone system in accordance with claim 25
24 wherein:

25 each said first radiotelephone controller includes: a

1 second radiotelephone controller which communicates with the
2 first radiotelephone transceiver which forms a first
3 radiotelephone with that first radiotelephone controller; and
4 an adjunct radiotelephone controller which communicates with
5 the second radiotelephone controller and with one or more
6 adjunct radiotelephone controllers of other of said first
7 radiotelephone controllers.

8 27. A telephone system in accordance with claim 26
9 further comprising:

10 a public switched telephone network linked to said
11 radiotelephone switching office; and

12 one or more further telephone stations linked to said
13 public switched telephone network.

14 28. A method for use in a radiotelephone system, the
15 radiotelephone system including one or more control channels in
16 which are carried paging signals which identify radiotelephones
17 to which calls are to be connected and in which are also
18 carried acknowledgment signals from the radiotelephones for
19 continuing the set-up of calls to the radiotelephones in
20 response to paging signals identifying the radiotelephones, the
21 method comprising:

22 receiving paging signals on a control channel with at
23 least one first radiotelephone transceiver;

24 and responsive to a first radiotelephone transceiver
25 receiving a paging signal carrying a telephone number identity

1 which is any one of a plurality of predetermined telephone
2 number identities, automatically controlling a radiotelephone
3 transceiver to generate an acknowledgment signal so as to
4 continue with the set-up of a call associated with the paging
5 signal.

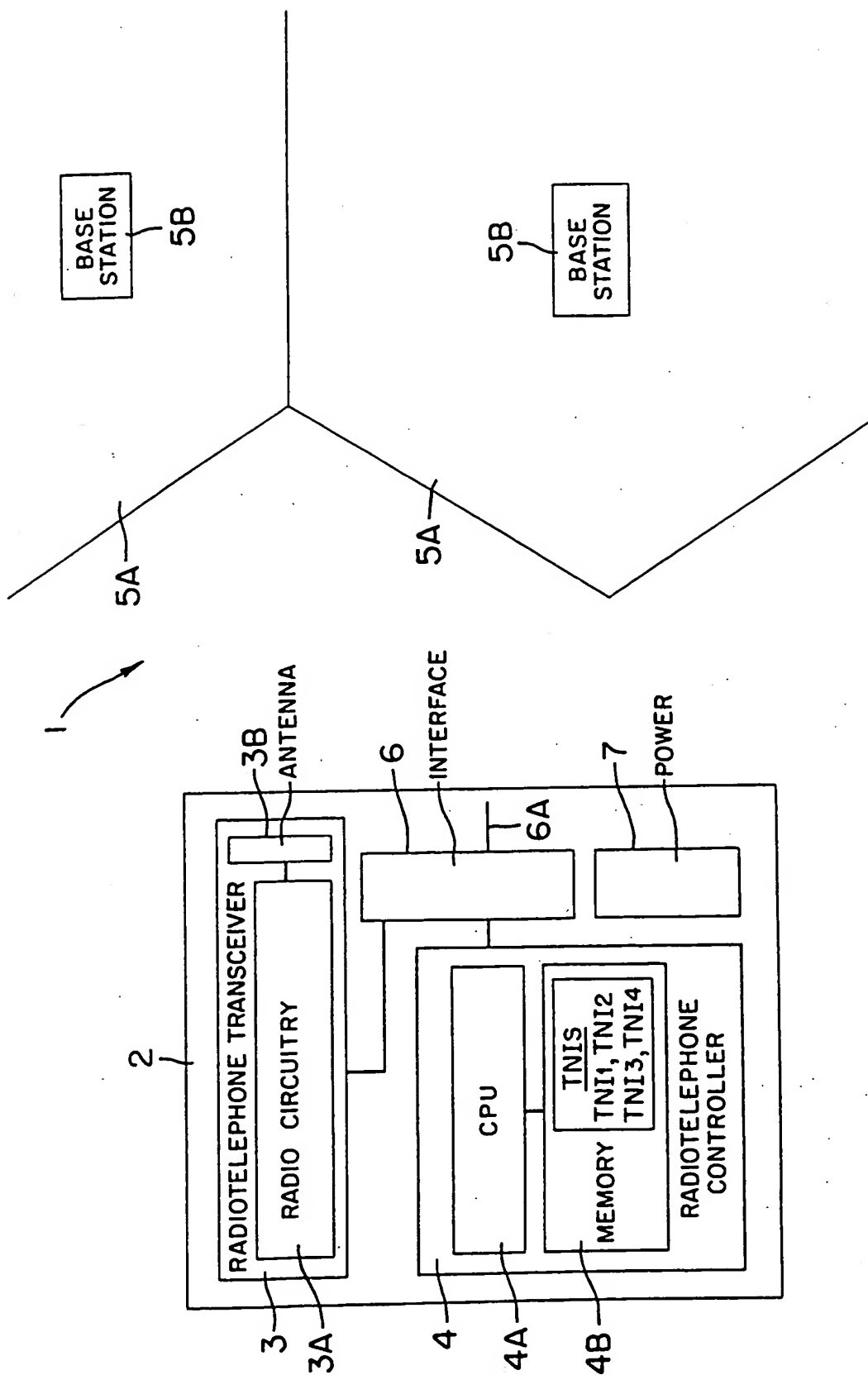


FIG. 1

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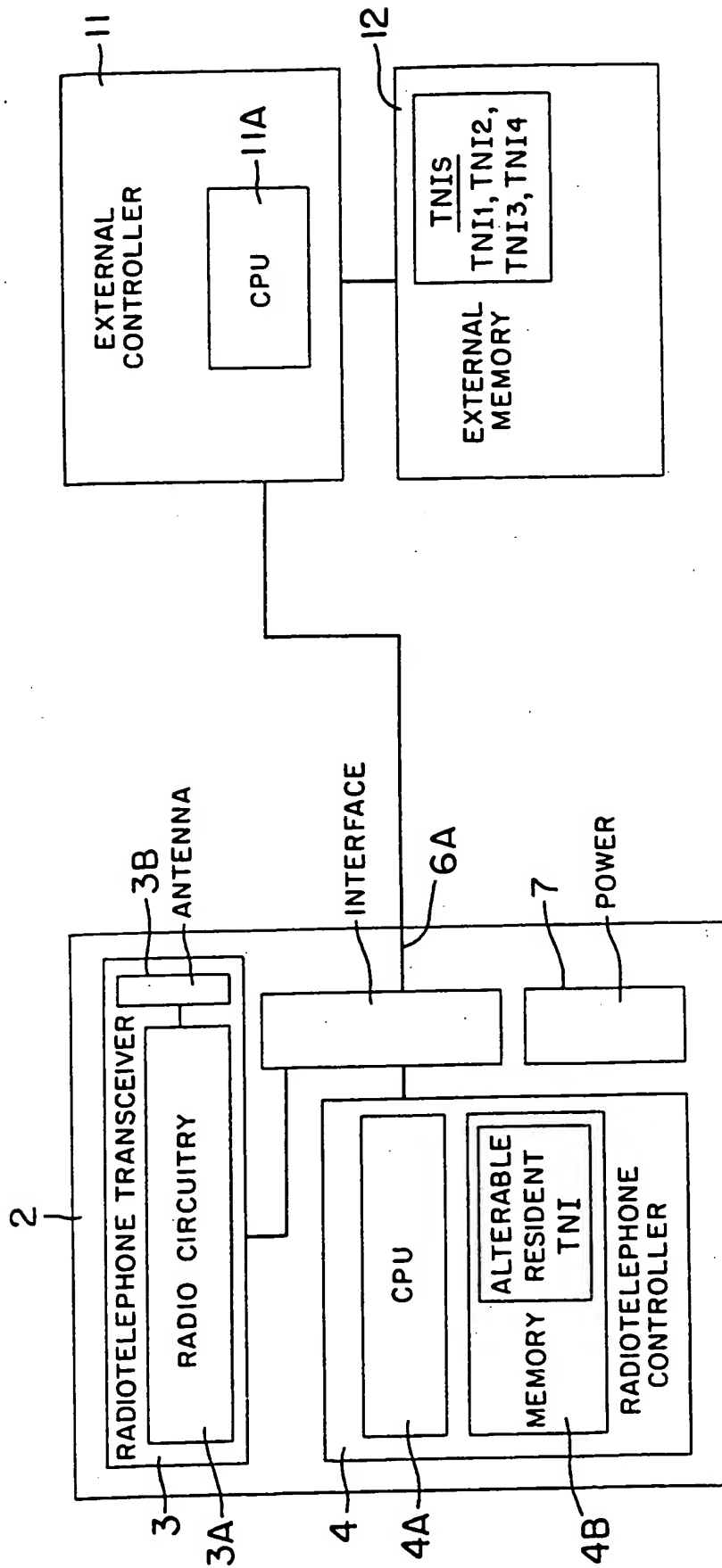


FIG. 2

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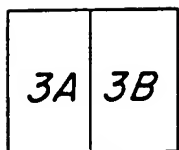
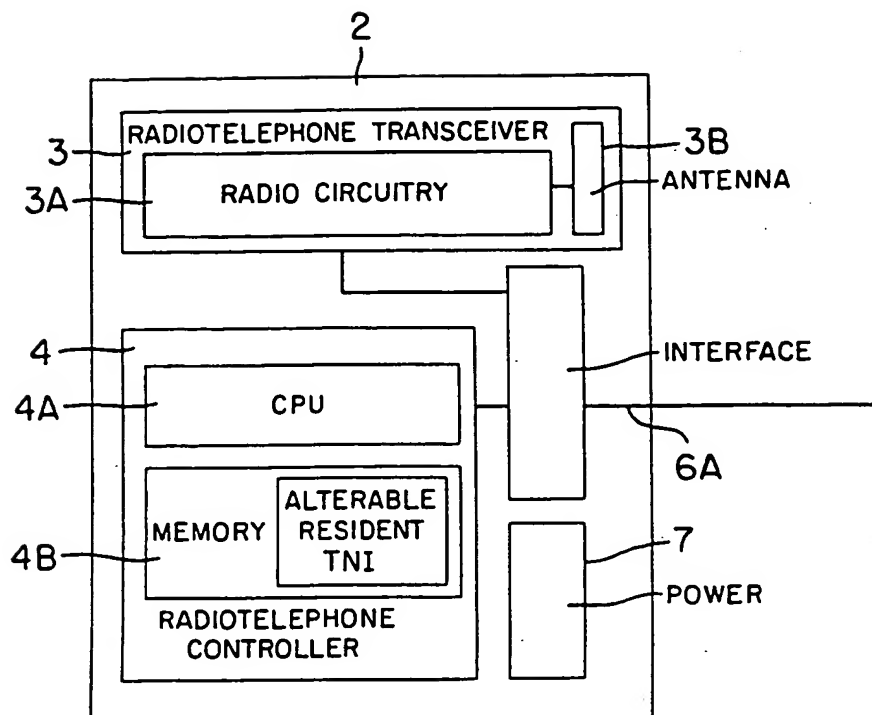


FIG. 3

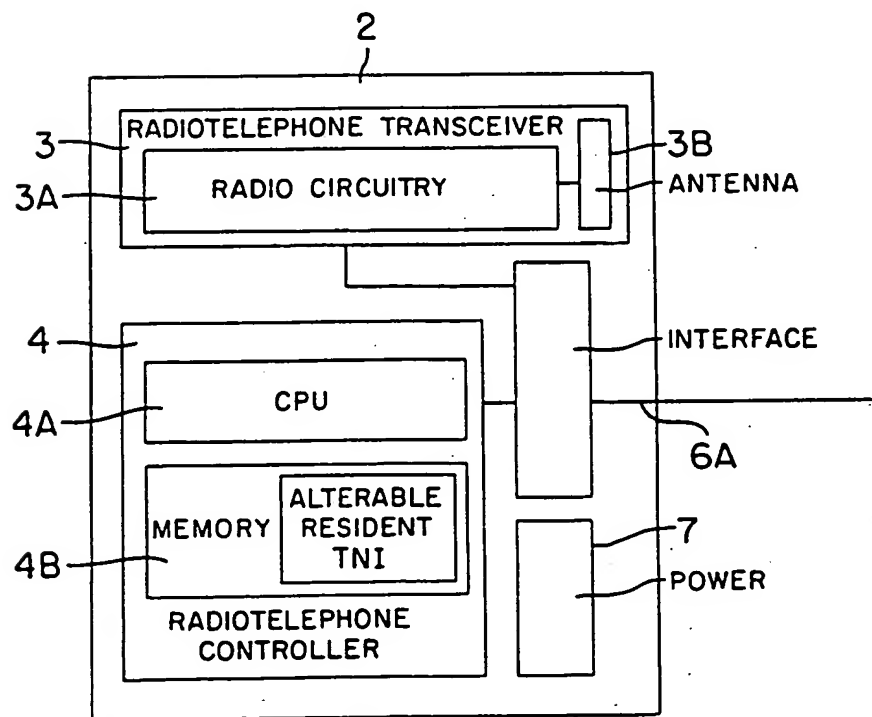


FIG. 3A

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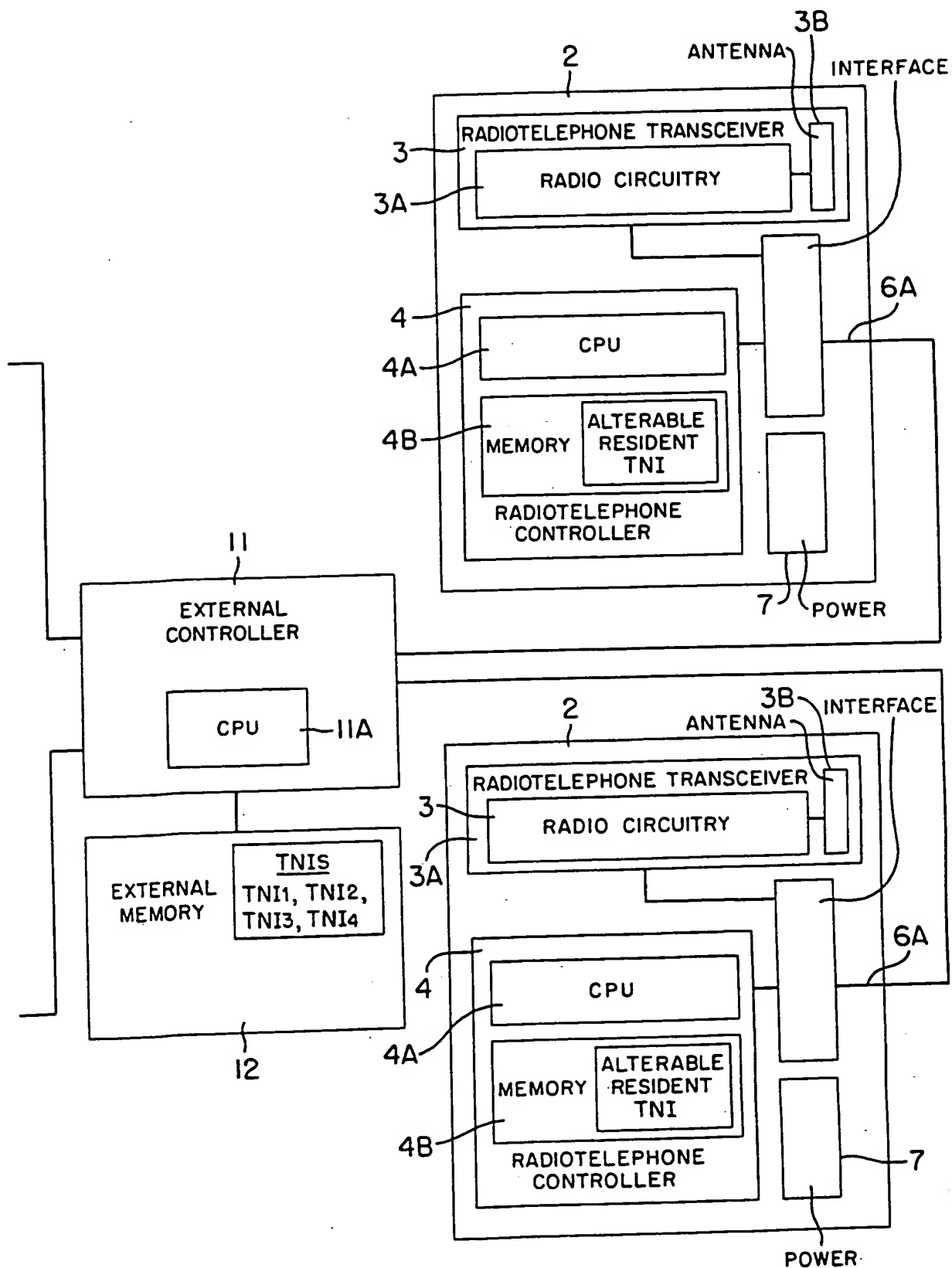


FIG. 3B

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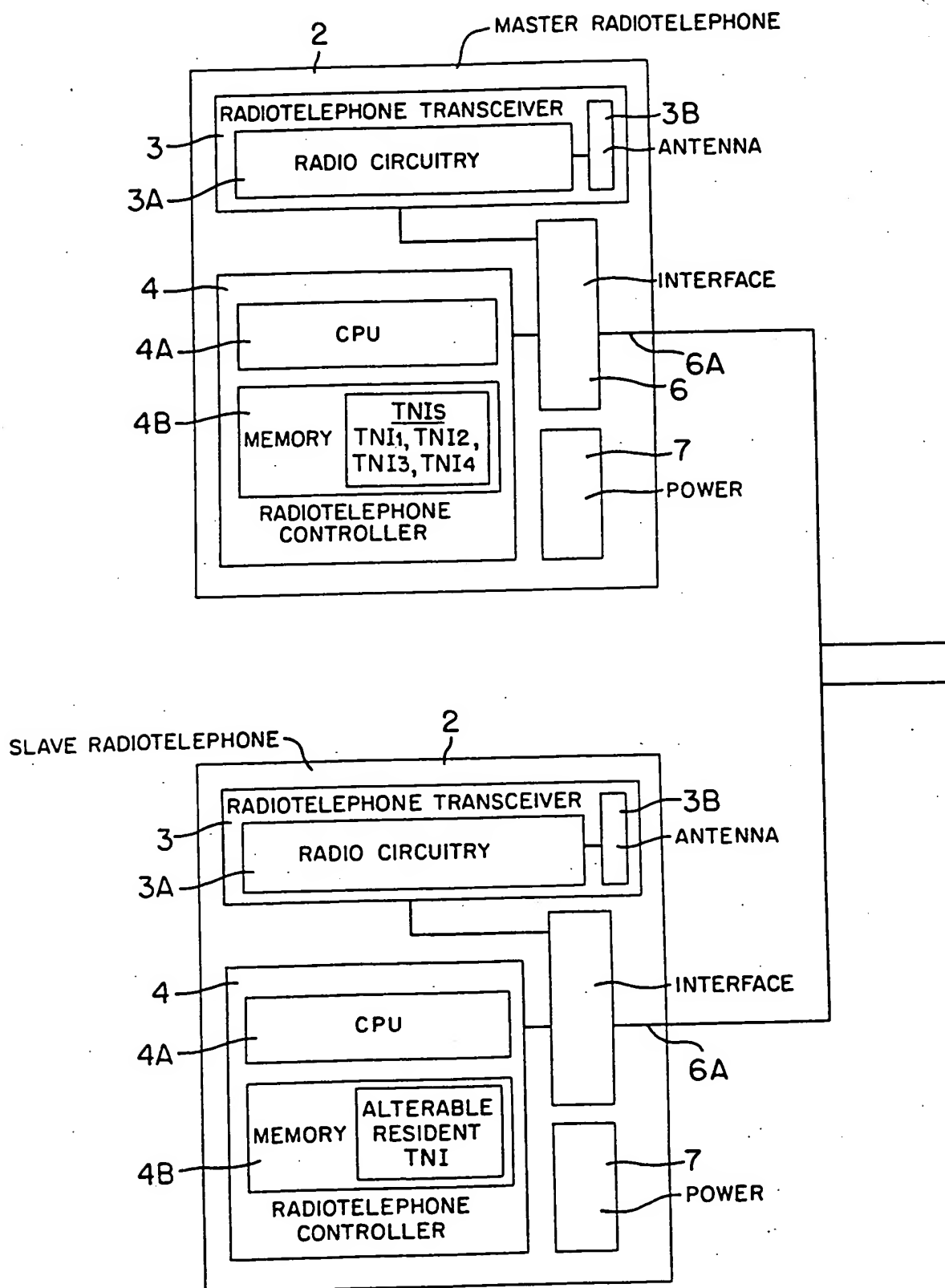


FIG. 4A

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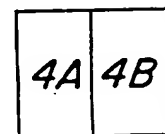
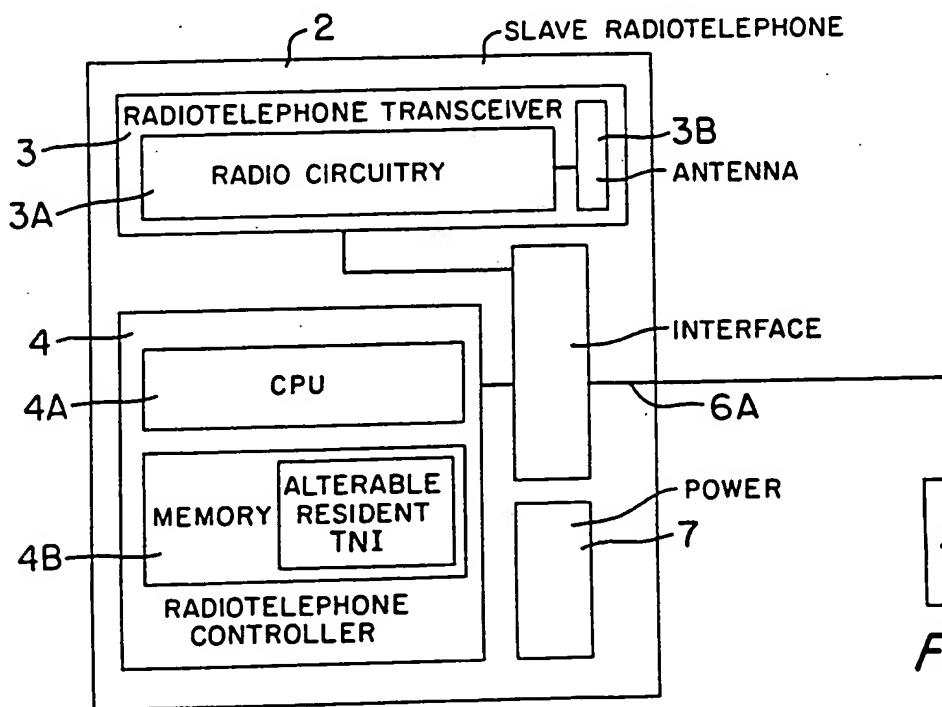
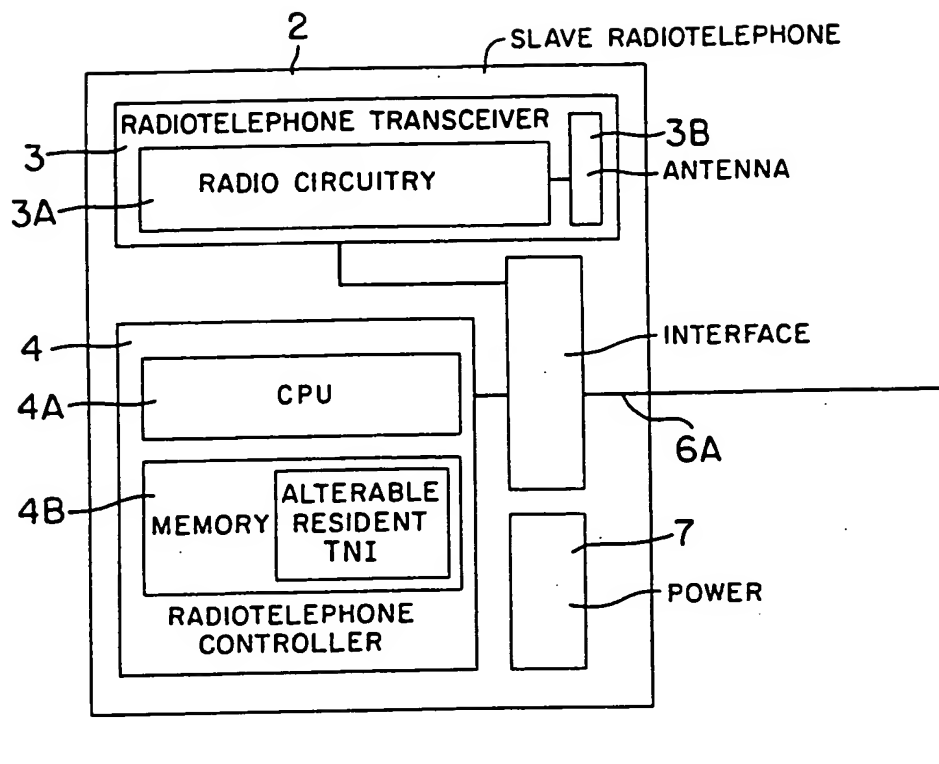


FIG. 4

FIG. 4B

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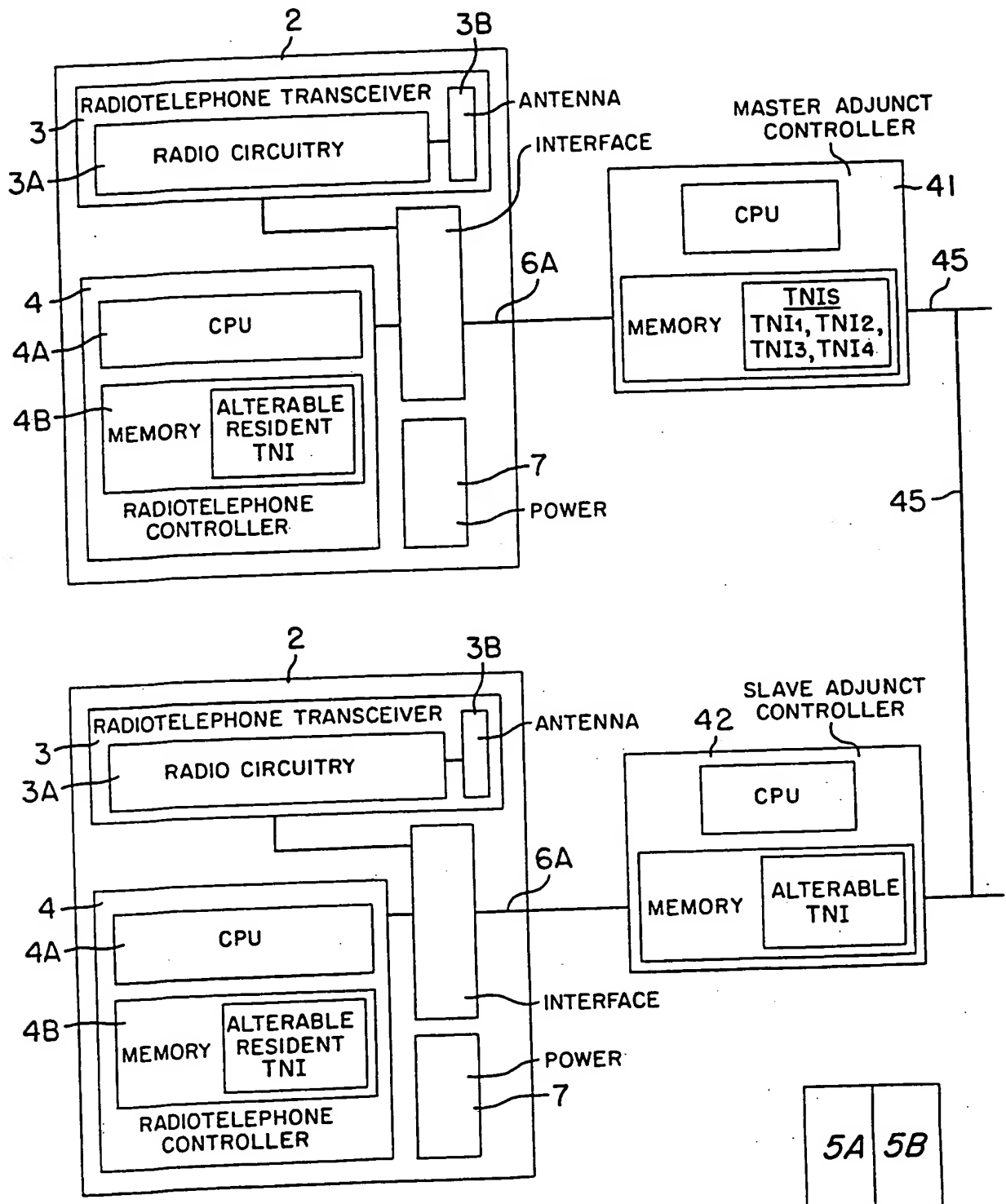


FIG. 5

FIG. 5A

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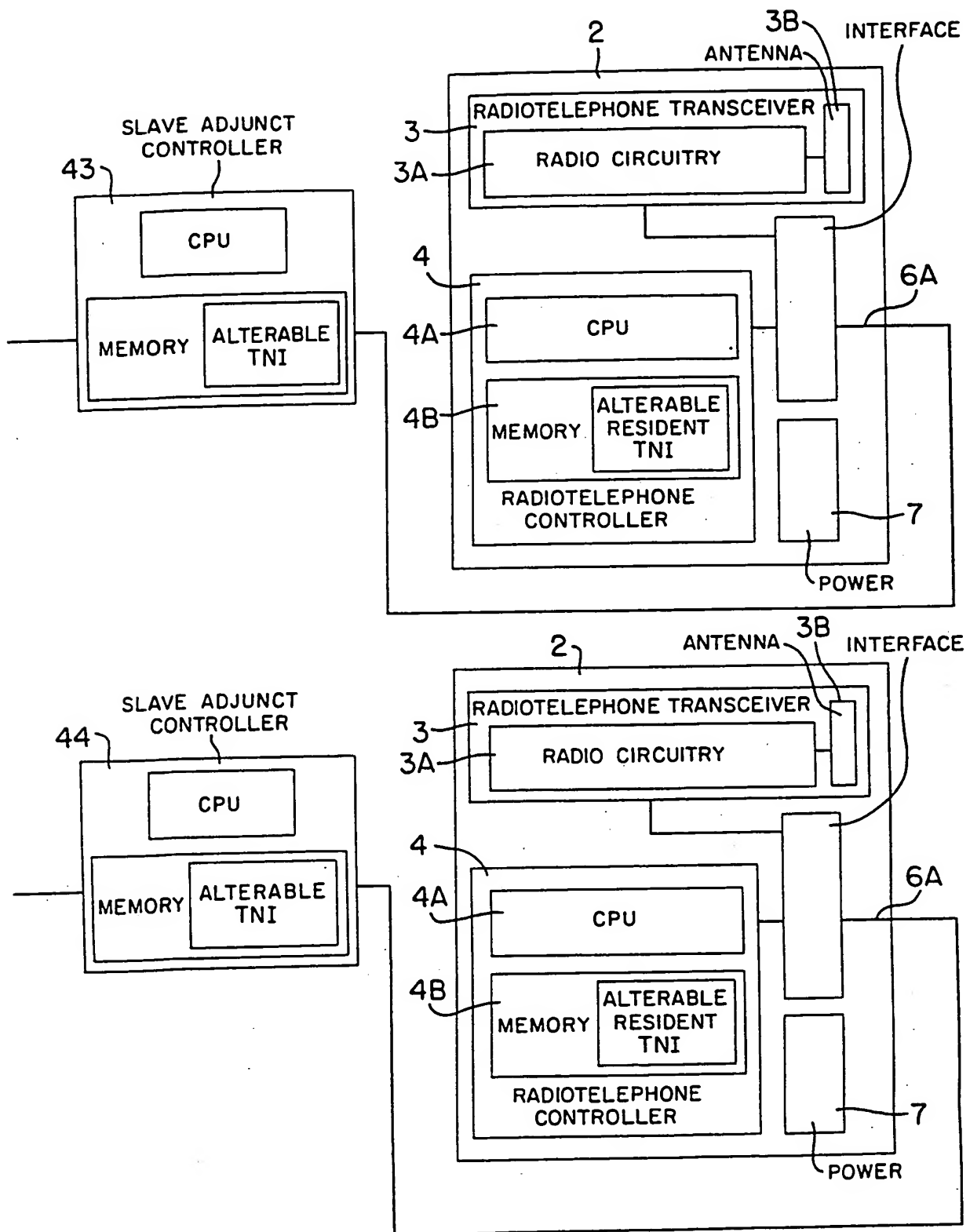


FIG. 5B

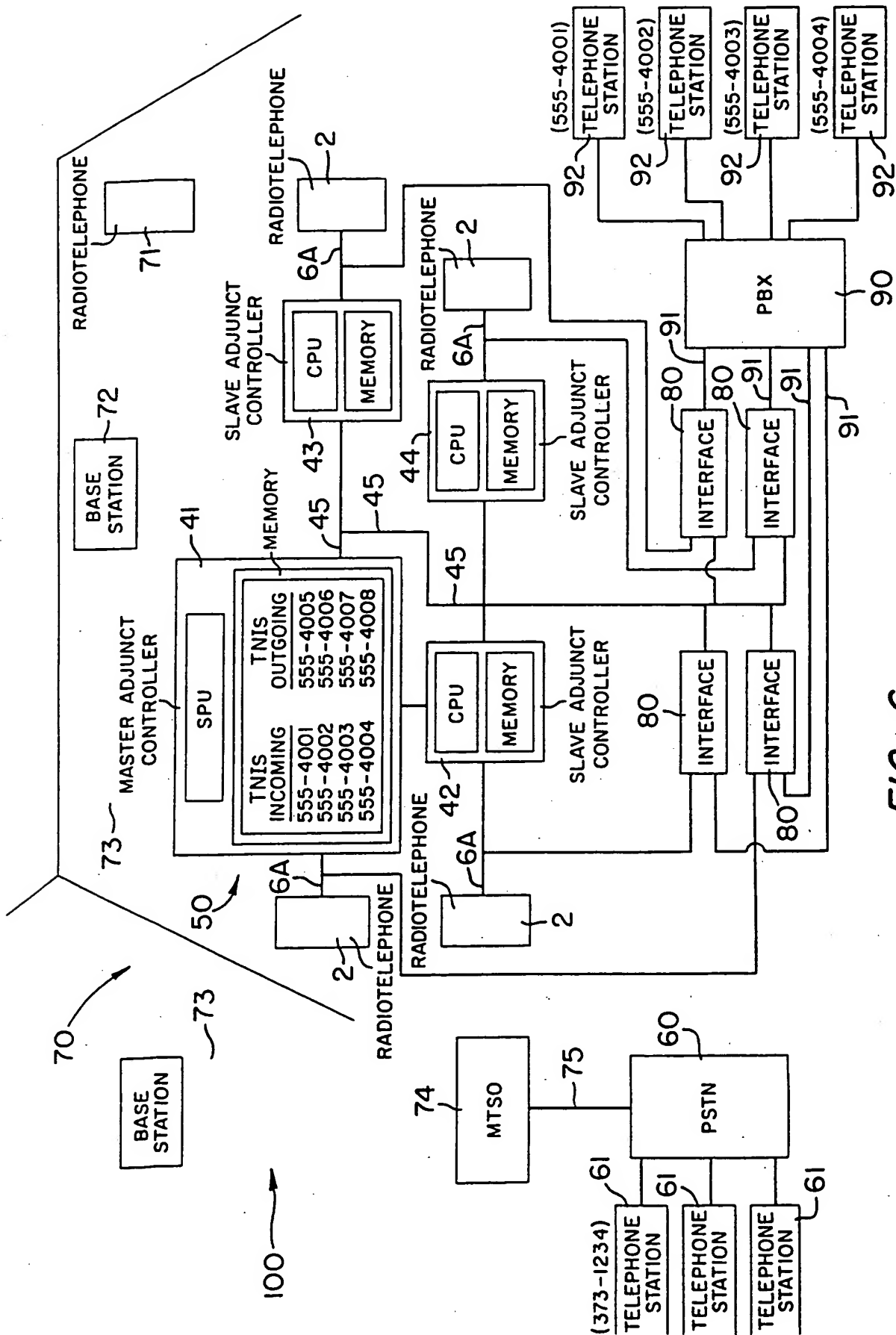


FIG. 6